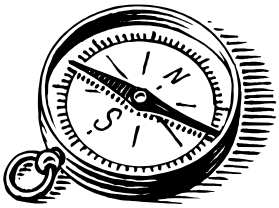
EPA Publication Number 250R03002

EPA Geospatial Blueprint

A Strategic Plan for EPA's Geospatial Program



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Vision for EPA's Geospatial Program
EPA will improve protection of the environment and public health through the efficient and effective use of geospatial data and technologies to conduct business

Background and Context

Regulators, analysts, researchers, and policy-makers have come to recognize that place is valuable for understanding environmental interactions, health effects, and environmental performance. Data that identify the geographical location and characteristics of natural or man-made features and boundaries, or geospatial data, are invaluable for most planning and decision-making activities at EPA. The EPA Geospatial Activities Baseline Assessment, completed in June 2001, identified more than 500 people, in nearly all EPA Program and Regional offices, who use geospatial data and technologies to support key business operations. Many more benefit from the products developed.

While the value of geospatial technologies to support business across the Agency has been demonstrated, several issues have limited the Agency's ability to optimize investments already made. Investments in these geospatial data and technologies are primarily made by individual offices, with relatively little cross-Agency coordination. Geospatial data and tools developed in one office are often difficult to find and share with another, even when needs are similar. There is no recognized leadership to foster coordination among offices using geospatial technologies. Many existing and potential EPA geospatial data and technology users and managers interviewed during the Baseline effort noted frustration with finding and gaining access to data and tools, with the quality and availability of data, and with telecommunications capacity. They indicated that these difficulties hindered their use of locational analysis in their operations. Recognition of the importance of these data and technologies to EPA and their extensive, but uncoordinated, use has led to development of this Geospatial Blueprint.

Proposed Geospatial Program

This Blueprint proposes a Geospatial Program that will leverage geospatial investments for EPA. The Geospatial Program has been conceived and developed based on input and insights from individuals across the Agency. This Blueprint outlines five major goals that support other key government-wide and Agency-wide information management strategic planning efforts such as the EPA Strategic Information Plan, the Federal and Agency Enterprise Architecture, and the Environmental Information Exchange Network (Exchange Network). Implementing the strategic goals and actions of this Blueprint will result in a Program that provides coordinated discovery, acquisition, management, and delivery of geospatial data, as well as faster, easier, and less costly access to applications for manipulating geospatial data. The Blueprint will enable the Agency to move from an environment where geospatial tools are considered ancillary to addressing business activities to one where they are viewed as essential to programmatic operations.

The Geospatial Program will support the geospatial component of the Federal and Agency Enterprise Architecture and ensure its alignment with key activities such as Enterprise Repositories, the Central Data Exchange, the System of Access, and the System of Registries. Additionally, the Geospatial Program will provide effective external representation of EPA's geospatial interests in the government-wide National Spatial Data Infrastructure and Geospatial One-Stop initiatives.

Geospatial Program Goals

The Geospatial Program goals were specifically developed and organized based on the components of the Federal and Agency Enterprise Architecture. These goals are supported by objectives and actions which are summarized below and described in detail in the remainder of this Blueprint.

GOAL 1: BUSINESS PROCESSES: Improve EPA decision-making by incorporating location-based approaches, data, tools and knowledge into EPA business processes.

Objectives: EPA managers, Program staff, and information service providers understand the importance, costs, and value of location-based analyses and decision-making.

- Involve managers and staff in developing the Geospatial Blueprint and Program,
- Recognize the importance of and incorporate location into Agency strategic planning and Enterprise Architecture planning efforts,
- Foster an understanding of Agency business functions and assess location-based needs, and
- Conduct cost-benefit analyses of geospatial approaches.

GOAL 2: DATA ARCHITECTURE: Provide EPA, its partners, and the public with the geospatial data they need to carry out EPA business processes and make environmental decisions.

Objectives: EPA staff produce and provide access to data of known quality and can find and access data produced by other sources.

- Enhance EPA's locational data, policies, and tools for locational data management to meet Regional and Program needs;
- Examine EPA's business transactions; coordinate opportunities to collect accurate locational data;
- Develop catalogs, indices, and registries as needed to facilitate the means to document and find geospatial data;
- Identify priority needs for geospatial data and develop partnerships for acquisitions; and
- Identify adopt, and implement data standards as required.

GOAL 3: APPLICATION ARCHITECTURE: Provide EPA staff, partners, and the public with applications and web-services to access, manage, use, analyze, present, and interpret geospatial data to conduct business and make environmental decisions.

Objectives: Geospatial tools are based on open and interoperable standards, are known by and accessible to EPA staff, and are supported with adequate training.

- Identify Agency priorities for tools and technologies and develop or acquire appropriate tools that are interoperable,
- Establish the means to share knowledge about existing tools with all EPA staff,
- Identify and use Geospatial WebServices as feasible to support EPA needs for geo-analysis,
- Identify adopt, and implement Web services standards as required.
- Establish software licensing agreements that result in cost-savings, and
- Provide EPA staff with access to training necessary to optimize the use of geospatial tools.

GOAL 4: TECHNOLOGY ARCHITECTURE: Design and implement an enterprise-wide technical infrastructure that supports access, use, management, and delivery of distributed geospatial data, applications, and Web services in a seamless manner.

Objectives: EPA staff and EPA contractors have access to hardware and bandwidth in secure, interoperable networks that provide public access as appropriate.

- Identify, incorporate, and support high speed network requirements for geospatial data and tool sharing within the Enterprise Architecture,
- Ensure hardware and networks are in place for managing and accessing data as necessary to support Region and Program needs,
- Identify and set priorities for funding and other requirements to support distributed, networked, hardware and software installations,
- Promote EPA staff participation in various industry and government standards efforts to ensure Agency interoperability and openness, and
- Establish effective means for public access to EPA data and analyses.

GOAL 5: GOVERNANCE: Establish an effective governance structure for setting priorities for geospatial investments, coordinating geospatial efforts, and communicating how geospatial data and technologies are used within the Agency.

Objectives: EPA managers and staff clearly define roles and responsibilities for leadership and coordination in geospatial activities, including incorporation of a strategic planning process that assists in establishing priorities, appropriate policies for ensuring coordination, and partnership opportunities.

- Establish leadership mechanism(s) (e.g., Geospatial Information Officer or Geospatial Committee) for guiding geospatial efforts within the Agency,
- Clarify roles and responsibilities for geospatial data collection, management, analysis, distribution,
- Identify and set priorities for geospatial investments based on Agency needs,
- Establish process to identify, adopt and implement needed standards, and
- Encourage and support partnerships for data and tool development.

Implementation of these various actions will be monitored, and necessary changes in course identified and taken. The Geospatial Program is intended to be a flexible and evolving effort that takes advantage of new and innovative technologies to assist Agency business needs.

Next Steps and Timeline

Several actions outlined in this Blueprint have already been initiated. Staff and managers from all key Program offices and all Regions have been involved in the development of this document. Conversations with key information technology staff responsible for the Enterprise Architecture and the Environmental Information Exchange Network are ongoing. An announcement for the GIO position has been issued and will soon be filled. The actions outlined above and described in more detail in the following pages represent the major next steps in developing a robust and effective Geospatial Program at EPA. Details about the timing and sequencing over the next several years are described for the various activities. Initial schematics and proposals for the geospatial components of the overall Enterprise Architecture are contained in the appendices of the document. Within five years EPA will realize the full benefits of

developing a coordinated and integrated Geospatial Program. Please contact Wendy Blake-Coleman (202-566-1709) for more information.

Acknowledgments

This Geospatial Blueprint was developed with the assistance and dedication of hundreds of users of geospatial data and technologies within the EPA. OEI thanks them for the valuable insights they provided on how EPA might make the best possible use of geospatial data and tools to improve the Agency's ability to protect human health and the environment. A special acknowledgment is extended to members of Geospatial Blueprint Team and the OEI Geospatial Team for the many hours they spent identifying and discussing critical Blueprint components and reviewing the document, and to Rebecca Moser for her editorial acumen.

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INTRODUCTION

Vision for EPA's Geospatial Program
EPA will improve protection of the environment and human health through the efficient and effective use of geospatial data and technologies to conduct business

Background and Context

The mission of the U.S. Environmental Protection Agency (EPA) is to protect human health and the environment. Nearly every aspect of environmental management can be associated with a location on earth. Incorporating data that identify the geographical location and characteristics of natural or man-made features and boundaries, or geospatial data, into business operations can dramatically improve the effectiveness of environmental planning and decision-making processes.

Currently, more than 500 people at EPA directly use geospatial data and technologies while many others rely on the maps and analyses developed by them for planning and decision making. Millions of dollars are expended annually at EPA for geospatial data, applications, and technologies, primarily on a project or program-specific basis. Yet, data and tools developed in one program are often difficult to share with others, even when needs are similar, sometimes resulting in a duplication of efforts.

In 2001, the "Geospatial Activities Baseline Assessment" documenting the extensive use of geospatial data and technologies across all EPA Programs and Regions was completed. The Baseline summarizes a number of issues that currently hinder Agency staff from using these data and technologies effectively. This Blueprint builds on the Baseline Assessment by outlining a Geospatial Program that will serve the interest of EPA as a whole. It outlines a cross-Agency Geospatial Program that coordinates and establishes practices for geospatial data and technology, leverages resources, and contributes to better information management and decision-making at EPA.

Several other information management initiatives are also underway at EPA. This Geospatial Blueprint is evolving in conjunction with the Agency Enterprise Architecture, which will ultimately provide the framework for all uses and investments in information technology at EPA. The Geospatial Program will ensure that the Enterprise Architecture efforts appropriately consider and incorporate geospatial assets. Work that is underway with the states and tribal governments to develop the Environmental Information Exchange Network (Exchange Network) has been expanded to consider the locational aspects of environmental data transported over the network. For example, the FY 2003 Exchange Network Grant solicitation makes activities that would improve locational coordinates for facilities, areas or boundaries needed to carry out EPA, State, Tribal and/or local environmental programs eligible for funding. Finally, the Geospatial Program will provide a much-needed focal point for geospatial aspects of priority activities at EPA, including environmental indicators, situational analyses, and homeland security responsibilities.

Outside of EPA, several efforts are underway to coordinate geospatial activities, including the activities of the Federal Geographic Data Committee to build the National Spatial Data Infrastructure and the interagency Geospatial One-Stop initiative. EPA's Geospatial Program will provide a mechanism for coordinating Agency representation in these external activities and ensure the effective communication of government-wide directives within EPA.

Use of Geospatial Technologies at EPA

Current Use

Environmental and public health protection requires not only an understanding of the distribution and current conditions of environmental resources, but the ability to correlate pollutant behavior. This includes where they are released, where they settle, where they may cause damage to both humans and natural resources, where control and regulatory mechanisms must be applied, and where monitoring is essential. These all require correlating locations against other variables and establishing relationships. Facilitating these connections is a primary function of geospatial applications. Examples of the EPA activities that use geospatial applications include the following:

Program Offices

- Protecting drinking water supplies
- Conducting analyses to help manage urban/suburban growth
- Responding to oil spills and other emergency situations
- Identifying sources of pollution for source water protection
- Examining and allocating regional acid precipitation allowances
- Conducting risk assessments
- Analyzing health conditions against pollutant distribution
- Modeling the distributions of invasive species
- Identifying priority sites for cleanup and enforcement actions

Regional Offices

- Developing Total Maximum Daily Load (TMDL) assessments for water bodies
- Tracking toxic substances
- Cleaning up and monitoring Superfund sites
- Monitoring water quality
- Assessing children's health
- Analyzing environmental justice situations
- Cleaning up hazardous waste sites
- Conducting environmental justice assessments
- Evaluating air emissions and ambient air concentrations
- Modeling watersheds and storm water drainage systems

Office of Research and Development

- Conducting habitat assessments and risk analyses
- Detecting and evaluating landscape patterns and changes
- Conducting real-time environmental monitoring and sharing the data with appropriate partners and stakeholders.
- Studying the effects of urbanization, at various scales
- Developing accuracy assessment protocols
- Creating 3-D visualizations of specific sites or larger geographic areas
- Analyzing the relationship between health and environmental contaminants

Issues with Use

While there are a wide variety of geospatial applications within EPA, most users believe that the Agency is not fully optimizing and leveraging how these tools are used. The Geospatial Activities Baseline Assessment identified a number of concerns that currently affect the ability to leverage existing resources at EPA. These include:

- Multiple sites of geospatial activity and no overall coordination or leadership, resulting in redundancy and an inability to leverage shared resources;
- Inability to find, access, and use current and complete geospatial data sets to support needed EPA analyses;
- Minimal existing quality control procedures to assist in developing and understanding the quality of geospatial data that EPA produces and accesses;
- Lack of resources and flexibility to develop shared data resources with external partners (e.g, states and other federal agencies);
- Inadequate bandwidth and telecommunication functionality to support transfers of large geospatial data sets;
- Inability to share geospatial knowledge (including applications) easily across Programs and Regions; and
- Lack of training for use of tools and development of skills at all levels (casual user to programmer).

Benefits of Implementing the Blueprint

The Geospatial Program outlined in this Blueprint will increase the effectiveness and efficiency of geospatial technology use at EPA in a variety of ways. Examples of benefits possible with an effective EPA Geospatial Program include:

- Enhanced ability to develop and use indicators of environmental condition such as the extent of wetlands, emissions of pollutants, and ambient environmental conditions;
- Improved ability to conduct multi-media environmental analyses;
- Improved response to situations involving hazardous materials;
- Improved means to use locational information obtained during the course of regulatory reporting and permitting processes;
- Better access to and use of distributed data sources and tools both inside and outside EPA through improved communication and web services; and
- Improved ability to integrate real-time environmental data for environmental assessment, emergency response, and enforcement activities.

Organization of this Document

The remainder of this Geospatial Blueprint presents the components of the Geospatial Program. These are presented in the same framework as the Enterprise Architecture:

- Understanding Agency business processes and how geospatial information can support them;
- Identifying the data, applications, and technology architectures needed to support Agency business processes; and
- Establishing organizational approaches that enhance the leadership and coordination of geospatial activities.

Each of the enterprise components includes a major goal, several objectives, and action items. Timelines for accomplishing the activities necessary to meet the goals and objectives are noted. These proposals were developed jointly by members of the Geospatial Blueprint Team, the OEI Geospatial Team and the National GIS Workgroup. They are intended to serve as starting points for dialogues with the Enterprise Architecture Teams, the Geographic Information Officer, and the Quality Information Council.

Following the body of this document are appendices that outline in detail preliminary proposals for geospatial data, technology, and governance infrastructures for the Agency. These proposals have been developed based on extensive discussion with staff and managers across EPA. The Appendices include:

- Principles for the Geospatial Blueprint (Appendix A)
- Definitions of Commonly Used Geospatial Terms (Appendix B)
- Proposed EPA Geospatial Data Architecture (Appendix C)
- Proposed EPA Geospatial Technology Architecture (Appendix D), and
- Proposed EPA Geospatial Governance Architecture (Appendix E)

PROPOSED EPA GEOSPATIAL PROGRAM

The strategic goals, objectives, and activities for the EPA enterprise-wide Geospatial Program are outlined on the following pages. The Program envisioned will support an internal and external network of shared, distributed geospatial data repositories and common application services which conform to mutually accepted open standards and are based on EPA's business needs. Data and applications that can be delivered over the Intranet and Internet via "geoservices" will be key.

The Program will enable geospatial data and applications to be used in both geospatial and non-geospatial applications to improve overall work processes at the Agency. This section of the Blueprint outlines current states, desired outcomes, goals, objectives, and action items for each of the major components of the Agency Enterprise Architecture, including business processes, data, applications, technology, and governance. The action items for achieving each objective under the five goals are listed chronologically in priority order for implementation. The lead offices for each action are also identified. Figure 1 depicts the goals discussed in the next several pages.

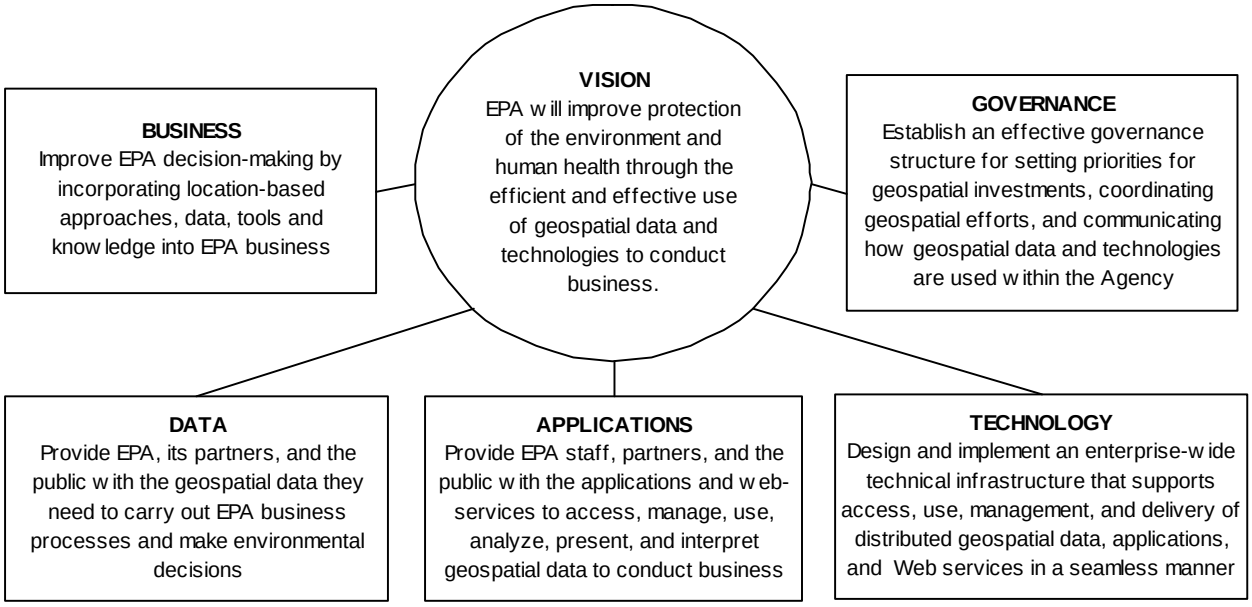


Figure 1: Vision and Goals of the Geospatial Program

The time frame for accomplishing all of the goals and objectives is within the next five years. Various activities are already underway, while some activities are dependent on the completion of other tasks, not specific to geospatial interests. The Agency's Enterprise Architecture efforts, and in particular the documentation of business processes and information and technology requirements to support those processes, are critical to understanding the role of location and geospatial data in the work of EPA. The Geospatial Program will develop in concert with other information resources both inside and outside of EPA, including network initiatives such as the Exchange Network, and data sharing efforts such as Geospatial One-Stop. Table 1 summarizes the time frames for the activities of the five goals. Most action items will have an individual project plan. The implementation of the activities will be tracked to measure overall progress in meeting the goals of the Geospatial Program outlined in this Blueprint.

Table 1: Time Frames for Geospatial Program Activities

Architecture Component	Current	Short Term (6 months-1 year)	Long Term (2-5 years)
Business Process	Mainly project specific	Decision support in key business areas	Widespread use in daily work processes
Data	Multiple, inconsistent indices	Authoritative index in Enterprise Repository	Authoritative index in Enterprise Repository
	Acquired and integrated independently	Enterprise acquisition of core data sets	Enterprise acquisition of core sets
	Multiple "clones"	Core data in Enterprise Repository	Increased use of NSDI master files
	Manual distribution with some online	Online distribution; some interoperable data access	Interoperable data access via geodata services
	Limited sharing	Geospatial Index and EPA Geodata Services, limited but growing NSDI / "Geography Network" directories	Geospatial One-stop/NSDI /geography networks
	Limited processes to generate and validate locational data	Improved interactive mapping tools and Web Services to assist in validating locational data	On-going validation and improvement of locational data through grant specifications, reporting requirements, and Web services.
Applications	Largely stand alone geospatial tools; non-reusable software components	Increased use of geo-application services concepts	Web-based geo-application services common; distributed tool stewardship
	""Thick"* - mostly Web browsers; limited mobile applications and pilot wireless applications	Some mobile applications; limited wireless applications	"Thin clients"* - mobile and wireless applications for analysis and data services
Technology	Largely coverages and legacy shape file systems; planning for DBMS	Web-enabling and Agency-wide migration to Spatial DBMS	Spatial DBMS implemented
	Workstations, local servers	Enterprise geospatial network of linked Regional and EPA National Computer Center repositories and servers	Investigating peer-to-peer architecture for geoservices and stewardship
	Archived databases with long lag time before data available to decision- makers	Efficient and effective querying of databases help decision-makers retrieve relevant information more timely.	Interoperable databases and data collection systems that optimize the time lag between measurement and decision.
	Security issues impede progress	Investment in improved security	Security resolved
	Low band-width wide area network	Investment in improved band-width	High band-width wide area network
Governance	Geospatial Program Governance Structure proposal under development	Geospatial Program Governance Structure adopted	Agency-wide governance body is in place and functioning
	No single focal point for coordinating geospatial activities	Geospatial Information Officer (GIO) hired	Increased coordination Agency-wide with accountability through the governance body.

*** Terms are defined in Appendix B**

Goal 1: Business Processes

Improve EPA decision-making by incorporating location-based approaches, data, tools and knowledge into EPA business processes

Current Status and Issues

Many EPA Program and Regional offices use location-based approaches, but their focus is usually on specific projects rather than on overall operational work processes. The Office of Water is the only Program office that uses location as a framework for addressing almost all their programmatic responsibilities. Region 4 has developed the South East Ecological Framework, in which geospatial data layers are a key component. They use this as a tool for many strategic and targeting decisions. Most other Programs and Regions are just beginning to recognize the usefulness of utilizing location as an enterprise framework for their programs and using geospatial data and technologies to integrate environmental management activities within and across media.

Desired Outcome

EPA Program Managers will understand how geospatial data, information, applications, and technologies can be meaningfully used to enhance their business operations. They will recognize when locational analysis can improve their decision-making processes and they will have ready access to the geospatial data and applications they need.

Objectives and Action Items

1.1 Foster appreciation for locational data and analyses in addressing environmental and related human health issues.

- Action 1.1.1: Engage EPA managers, staff, and partners in developing and maintaining the EPA Geospatial Blueprint. (OIC. FY 2002-3.)
- Action 1.1.2: Participate in EPA overarching Strategic Planning and Enterprise Architecture efforts to ensure the incorporation of location-based approaches. (OIC, OEI Geospatial Team with Program and Regional staff. Ongoing.)
- Action 1.1.3: Communicate and demonstrate the effectiveness of location-based analyses through Agency-wide newsletters, joint pilots/projects and events such as GIS Day. (GIO, and OEI Staff with Program and Regional staff. Ongoing.)

1.2 Assist EPA Program Managers to understand how locational information can support specific business processes.

< Action 1.2.1: Identify the current and potential role of location-based approaches in two to four key business processes annually and develop tools as appropriate. (OIAA with program and Regional staff. Ongoing.)

< Action 1.2.2: Identify Agency-wide needs for geospatial data, analytical tools, and products through a biennial survey of EPA Program offices and Regions based on their specific business functions. (OIC with Program and Regional staff. Summer/Fall 2003.)

1.3 Assist in assessing costs and benefits of using geospatial data, technologies, and analyses to address EPA business needs.

- Action 1.3.1: Conduct a Geospatial Program cost benefit analysis in support of the FY 2005 budget. (OIC with OEI Geospatial Team, Program Offices, and Regional Offices.) Spring/Summer 2003.)
- Action 1.3.2: Provide templates to EPA Programs and Regions to help them examine and set priorities among investments in geospatial data, tools, and technologies. (OEI Staff. Fall/Winter 2003/4.)

Goal 2: Data Architecture

Provide EPA, its partners, and the public with the geospatial data they need to carry out EPA business processes and make environmental decisions

Current Status and Issues

Geospatial data at EPA are often difficult to find, access, and use. Data tend to be acquired in an ad-hoc manner, with some data sets being purchased and stored multiple times. Regional and Headquarters offices maintain independent geospatial libraries that are not built in such a way that they can be easily integrated. In addition, network access to geospatial data is difficult and the quality of the data is not well known or communicated. EPA does not have procedures for ensuring that locational data are collected in a consistent and accurate manner. EPA's geospatial data partnerships with states and other federal agencies tend to be ad-hoc and based on limited, currently available funding.

Desired Outcome

All EPA offices, partners, and the public, will know what geospatial data EPA manages and maintains and its quality, and will be able to find the data and metadata they need using enterprise-wide indices, registries, or catalogs. Regional and Headquarters offices will jointly maintain a repository so that duplicate data purchases and unnecessary storage requirements are eliminated. In addition, the geospatial data reported to EPA in the course of regulatory reporting activities will be captured for future use. Data users will have effective means to express needs for data. These needs will be understood by senior managers and addressed as annual budgets are developed and expended and as partnerships are established for data with States and other federal agencies.

Objectives and Actions

2.1 Ensure that geospatial data are accurate, well documented, and available to all users.

- Action 2.1.1: Develop options and an implementation plan for increasing the locational accuracy of data for which EPA is responsible or funds. (OIC Staff with Program and Regional staff. Spring/Summer 2003.)
- Action 2.1.2: Revise the EPA Locational Data Policy to include requirements that locational attributes and Federal Geographic Data Committee (FGDC)-compliant metadata be included with all geospatial data funded by EPA. (OEI Staff with LDIS. Spring/Summer 2003.)
- Action 2.1.3: Establish clear and appropriate guidance for collection and maintenance of EPA's locational data (e.g. FRS and LRTs) to better address Regional and National Program Office

needs. (GIO, OEI staff, and LDIS. Summer/Fall 2003.)

< Action 2.1.4: Use the Enterprise Architecture business process modeling as a starting point to identify opportunities to obtain locational data during routine EPA business activities (e.g., inspections). Develop guidance or procedures as appropriate to ensure data accuracy and a means to access. (Program Staff. Summer/Fall 2003.)

< Action 2.1.5: Work with Program Managers to ensure key regulatory facility databases and other data sets (e.g., water quality standards) contain locational data adequate for their intended use. (GIO and Program Managers. Fall/Winter 2003.)

2.2 Provide indices/catalogs of geospatial data to facilitate use by EPA personnel.

< Action 2.2.1: Enhance the Geospatial Data Index and integrate it with other efforts such as the interagency Geospatial One-Stop Initiative, EPA System of Registries, and System of Access for the National Environmental Information Exchange Network. (OEI Staff. FY 2003 and then ongoing.)

< Action 2.2.2: Establish Agency-wide policies and procedures to ensure that information about the availability of geospatial data is current, well organized, and well documented. (GIO with OEI and Program and Regional staff. Winter 2004.)

< Action 2.2.3: Continue to identify and assess the best mix of external versus internal EPA solutions for accessing, acquiring, managing, distributing, and standardizing key geospatial data to meet Agency business needs more effectively. (GIO with OEI and Program and Regional staff. Winter/Spring 2004.)

2.3 Ensure that all geospatial data collected or funded by EPA are of known origin and quality.

< Action 2.3.1: Conduct peer review of "Guidance on Quality Assurance Project Plans for Geospatial Data" and finalize. (OEI Quality Staff with Program and Regional staff. Winter 2003)

< Action 2.3.2: Facilitate EPA Program and Regional efforts to implement the FGDC metadata standard (OIC with EPA Program and Regional offices. Winter/Spring 2003.)

< Action 2.3.3: Examine needs for additional metadata (e.g., feature- or transaction-based) and engage the Environmental Data Standards Committee and/or FGDC in considering the development of standards for such metadata (OIC with Program and Regional staff. Summer/Fall 2004.)

2.4 Participate in efforts to improve the quality and accessibility of geospatial data nationwide.

< Action 2.4.1: Increase participation in State and national efforts that promote more effective use of geospatial data for environmental decision-making (e.g, National States Geographic Information Council (NSGIC), FGDC, Geospatial-OneStop). (GIO and OEI Staff. Ongoing.)

< Action 2.4.2: Participate in developing eXtensible Mark-up Language/Geographic Mark-up Language (XML/GML) standards to meet EPA needs for specific geospatial themes (e.g., hydrography, transportation) and provide training to ensure Agency-wide awareness of how to use and implement these standards. (GIO and OIC Staff. Spring 2003 and ongoing.)

< Action 2.4.3: Set priorities for acquiring and entering into geospatial data acquisition, development or exchange partnerships to ensure the availability of geospatial data needed for EPA business. (OIC with Program and Regional Staff. Summer/Fall2003.)

< Action 2.4.4 : Clarify OEI and ORD roles and responsibilities with respect to remote sensing and develop a strategy for enhancing collaboration in this arena (Remote Sensing Roadmap). (GIO with OEI and ORD staff and management. Summer 2003.)

< Action 2.4.5: Establish standard grant and contract requirements to ensure that environmental data collected or developed with EPA funds are compliant with the EPA latitude/longitude standard and FGDC data and metadata standards. (OIC and Program Staff. Winter/Spring 2004.)

Goal 3: Applications Architecture

Provide EPA staff, partners, and the public with the applications and web-services to access, manage, use, analyze, present, and interpret geospatial data to conduct business and make environmental decisions

Current Status and Issues

There are over 70 geospatial applications in use throughout the Agency; however these are actively used by only about 500 of the 18,000 EPA employees. Many who could benefit from using geospatial analyses in their work do not because they do not know of their existence or find them too difficult to access and use without training. Many of the applications that currently exist have been created independently in different Regions or Programs (e.g., Environmental Justice tools). Some duplication occurs because Regions have different requirements and time frames within which they are working or significantly different geographic conditions. Duplication also exists because there is no often no standard Agency-wide policy or guidance for implementing national programs and slightly different tools are developed to satisfy the implementation approach developed in specific Regions. This is compounded by the lack of enterprise-wide search mechanisms to identify and share existing applications that might meet multiple needs. Additionally, requirement assessments for applications have not generally involved a broad cross section of Programs and Regions. Where enterprise geospatial tools have been developed by OEI, they have often focused on public access rather than internal Agency business areas. In addition, geospatial software licenses have been difficult to track, resulting in inefficiencies in purchases and maintenance.

Desired Outcome

EPA staff, partners, and the public will be able to identify agency applications available for manipulating and displaying geospatial data via an enterprise index or catalog. Software will be interoperable and based on open standards. Most of these tools will be available through desktop Web browsers, however mobile and wireless applications will also be available for field work. Easy to use web-based services will significantly increase access to geospatial data and technologies by EPA Program Managers and analysts. Geospatial training will be available to EPA staff as needed. As new needs for analysis are identified, EPA offices will work together to develop the most appropriate applications drawing on expertise from across the Agency.

Objectives and Action Items

3.1 Increase Agency-wide awareness of and access to available geospatial tools to conduct EPA business.

< Action 3.1.1. Develop geospatial applications that support EPA business activities. (OIAA, OTOP, and Program and Regional offices. Ongoing.)

< Action 3.1.2. Monitor the evolution of commercial geospatial web services for possible use by EPA and provide recommendations to the CIO, GIO and QIC on the use and/or responsibilities to support such services to enhance or facilitate EPA work. (OEI offices with Program and

Regional staff. Ongoing.)

< Action 3.1.3. Assess and establish blanket licensing agreements as appropriate to facilitate Agency-wide access to geospatial software. (OIC with OEI, Program and Regional offices. Spring/Summer 2003.)

< Action 3.1.4. Establish and implement procedures and tools to document, inventory, and advertise all geospatial applications and services developed within EPA (including by states with EPA funding). (OEI Geospatial Team with Program and Regional Offices. Summer 2003.)

< Action 3.1.5. Set Agency priorities for acquiring or developing geospatial applications in annual budget and operating plan processes using results of the biennial survey process (see action 1.2.2). (OIAA with Program and Regional offices. FY 2004 then ongoing.)

< Action 3.1.6. Establish criteria for evaluating potential software acquisitions, including the ability of the product to meet EPA functional needs. Conduct bench-marking analyses as necessary. (OTOP with Program and Regional offices. FY 2004 then ongoing.)

3.2 Incorporate open and interoperable standards when developing EPA geospatial tools.

< Action 3.2.1: Participate in industry efforts and public-private partnerships to develop open specifications. (OEI Offices and Program and Regional offices. Ongoing.)

< Action 3.2.2: Design and implement effective means to access and use open source code for geospatial applications. (OEI Staff. Ongoing.)

3.3 Provide EPA staff with access to training needed to use geospatial tools as effectively.

< Action 3.3.1: Identify employee training needed for various geospatial tools. (OEI Staff. Fall 2003.)

< Action 3.3.2: Develop a Geospatial Training and Workforce Development Plan. (OEI Geospatial Team with Program and Regional offices. Spring/Summer 2004.)

< Action 3.3.3: Implement the Geospatial Training Plan. (OEI Offices with Program and Regional offices. FY04.).

Goal 4: Technology Architecture

Design and implement an enterprise-wide technical infrastructure that supports access, use, management, and delivery of distributed geospatial data, applications, and Web services in a seamless manner

Current Status and Issues

EPA's geospatial activities are currently supported by a diverse array of handheld devices, personal computers, servers, and networks which were documented in the Geospatial Baseline (2001). EPA's technical infrastructure[1] was originally designed to support individual and independent applications, without considering needs for enterprise-wide data exchange. While the current configuration supports many distributed users, EPA Regions and Program offices often have difficulty accessing and sharing data due to limitations in both network configuration and capacity. In some cases, network bandwidth within offices is significantly less than between offices across the country, creating challenges for inter-regional, headquarters, and National Computer Center exchanges. In addition, EPA security concerns have created new challenges in sharing data with external partners. Use of Web tools and technology to

[1] A technical infrastructure includes hardware, operating systems, software, and networks.

deliver GIS and other geospatial products is generally restricted to those offices with significant funding and the ability to navigate difficult technology and administrative hurdles.

Desired Outcome

EPA staff will be able to access, process, and manage geospatial data needed at any time to accomplish their operational responsibilities, including sharing the data with EPA partners. EPA information technology managers will have a clear understanding of all components of the technical infrastructure and how to optimize performance. Managers will be able to add, delete, and/or replace components of the architecture as needed based on compliance with open standards. Specific field sites will be able to provide GIS and other geospatial products via the Web. This will enable innovation by Program and Regional offices that can be scaled up for broad audience use as appropriate.

Objectives and Action Items

4.1 Provide EPA staff with access to computing resources and network capacity to support collection, use, management, and distribution of geospatial data.

< Action 4.1.1: Work with the EPA Enterprise Architecture Team to ensure that geospatial user needs are addressed as the Agency's technical infrastructure evolves. (OEI Geospatial Team with Program and Regional offices. FY 2002-3)

< Action 4.1.2: Identify key hardware/network needs of Regions and Programs based on required functionality and develop an acquisition strategy. (Region, Program, and OEI Staff [NTSD]. Winter/Spring 2003.)

< Action 4.1.3: Identify performance measures and conduct testing of various network/hardware configurations to ensure proper functioning in normal and emergency situations. (OEI Staff [NTSD] with Regional and Program Staff. Summer 2003.)

< Action 4.1.4: Implement the EPA Geospatial Network based on work completed under actions 4.1.1 and 4.12. (OEI/NTSD with Regions and Programs. FY2003-4.)

< Action 4.1.5: Ensure that all nodes within the EPA geospatial network are properly staffed and fully operational. (GIO, QIC, and OEI Staff. Winter FY 2003-4 and ongoing)

< Action 4.1.6: Provide access to equipment and training for inspectors and other on-the-ground staff to help them collect geospatial data in the course of their regulatory and monitoring activities. (OEI Staff. FY 2004 and then Ongoing)

4.2 Ensure that the security of EPA geospatial data and applications is protected, while allowing appropriate exchanges of data with partners and stakeholders.

< Action 4.2.1: Establish network protocols to allow the exchange of geospatial data with external users, coordinating such efforts with the Agency's broader EA and NEIEN activities as appropriate. (OEI Geospatial Team with Program and Regional offices. FY 2003.)

< Action 4.2.2: Establish secure Web-services that enhance the ability to share EPA data and tools with external partners via the internet and extranet. (OIAA, OTOP, and Program and Regional offices. Ongoing)

< Action 4.2.3: Develop a white paper on moving to use of new technology architectures (e.g. "N-Tier" architectures) to enhance access to EPA geospatial information. (OTOP and OIC. Winter2003/spring 2004.)

4.3 Build the EPA geospatial technology architecture based on open standards that foster interactions with other partners and the timely implementation of emerging technologies.

< Action 4.3.1: Increase EPA participation in standards testing and protocol development with the Open GIS Consortium, Inc. and other industry-public sector consortiums to ensure open architectures are developed that meet EPA needs. (OEI Staff and others as appropriate. Ongoing.)

< Action 4.3.2: Upgrade the Agency's desktop operating system and desktop applications to support XML/GML. (OEI [OTOP]. FY 2002-3.)

< Action 4.3.3: Develop appropriate hardware guidelines for Agency procurements to ensure the interoperability of hardware components. (OTOP/NTSD with Program and Regional offices. FY2004-5)

Goal 5: Governance Architecture

Establish an effective governance structure for setting priorities for geospatial investments, coordinating geospatial efforts, and communicating how geospatial data and technologies are used within the Agency

Current Status and Issues

Regions, Programs, ORD, and OEI offices make independent investments in geospatial data, applications, and technologies with only a partial understanding of other agency geospatial efforts. In some cases this results in inefficiencies and duplication. Offices needing assistance in geospatial activities do not know where to turn for full support. Specific roles and responsibilities are not clear, and offices, to some extent, compete for resources. Standards are developed that are not used or enforced, and in other situations potentially valuable standards have not been identified and adopted. Existing coordination efforts (e.g. National GIS Workgroup) tend to focus on technical solutions and information exchange, rather than joint application project definition and management or planning for future needs. Partnership interactions tend to be ad-hoc and uncoordinated.

Desired Outcome

The leadership and governance structure for geospatial activities will be clearly articulated. It will provide guidance and coordination in setting priorities and pursuing investments. Managers, users and potential users of geospatial technology understand their responsibilities, know where to turn for assistance, know how agency geospatial investment priorities are being decided, and have opportunities to provide input into the process. Agency guidelines and standards, based on interoperability, for collecting, documenting, and managing geospatial data will be implemented. Trends in geospatial technologies and EPA geospatial activities will be examined at least every other year and decisions will be made about directions and priorities. Nearly all of EPA data investments will be pursued in strategic partnership with other federal, state, and private sector entities.

Objectives and Action Items

5.1 Clarify and communicate roles and responsibilities of Program offices and Regions to support use of geospatial data and technologies.

< Action 5.1.1: Advertise and fill the GIO position. (CIO. Winter/Spring 2003)

< Action 5.1.2: Clarify responsibilities of the newly created GIO position and relationships with existing OEI Geospatial Teams and activities. (CIO. Spring/Summer 2003)

< Action 5.1.3: Validate recommendations on the roles, responsibilities, and linkages among existing geospatial activities outlined in the Blueprint. (CIO, GIO, with OEI, Program and Regional staff. Fall/Winter 2003/4)

< Action 5.1.4: Recommend to the QIC proposed roles for various offices, teams, and working groups to accomplish the goals of this Blueprint. (CIO & GIO. Winter/Spring 2004)

< Action 5.1.5: Identify stewards for various components of the Agency's distributed geospatial infrastructure and implement appropriate components of the Agency Quality System (e.g. metadata access, software development life cycle) monitored with feedback to respective managers). (CIO, GIO, and QIC. Spring 2004)

5.2 Implement a geospatial strategic planning process to set the future direction and priorities for the Geospatial Program

< Action 5.2.1: Establish priorities for geospatial investments based on top identified needs. (GIO & OEI Staff. Fall/Winter 2003 and ongoing)

< Action 5.2.2: Identify mechanisms to track advances in technologies and EPA needs for geospatial data and technologies. (GIO. Winter 2004 then ongoing)

< Action 5.2.3: Outline and make recommendations to the QIC strategies for obtaining and maintaining funding to support geospatial priorities. (GIO & OEI Staff. Spring 2004)

< Action 5.2.4: Establish an ongoing process to update the Geospatial Activities Baseline Assessment and EPA Geospatial Blueprint as needed. (OIC staff with GIO, OEI, Program and Regional offices. Spring 2004)

5.3 Adopt geospatial policies and standards to facilitate the use of geospatial data and technologies across EPA.

< Action 5.3.1: Participate in the various federal, international and industry efforts to exchange data via XML/GML and actively promote these exchanges by EPA. (OIC with OEI, Program and Regional offices. Ongoing)

< Action 5.3.2: Review and update as appropriate existing EPA locational policies and guidelines related to key data collections and submissions so that requirements reflect advances in technology that enable greater accuracy, precision or timeliness. (OIC with OEI, Program and Regional offices. FY 2004 and then ongoing)

< Action 5.3.3: Identify needs for data and technology standards and designate individuals from across the Agency to participate in standards development activities (e.g., OGC and FGDC) or establish

process within the EDSC to ensure development. (GIO with OEI, Program and Regional offices. Winter 2004)

< Action 5.3.4: Provide ongoing training on how to implement and use adopted Agency geospatial policies and standards. (OIC and OTOP. FY 2004 and then ongoing)

< Action 5.3.5: Adopt policies and requirements for EPA grants to states that require environmental data funded by EPA to be compliant with EPA and FGDC locational data and metadata standards (See Action 2.4.3). (QIC & Program Offices. Winter 2004)

5.4 Enhance and maintain partnerships within EPA and between EPA and partners to support use of geospatial data and technologies.

< Action 5.4.1: Ensure active participation in the FGDC and OGC and communicate about these activities to all interested EPA parties (GIO with OEI, Program and Regional offices. Ongoing)

< Action 5.4.2: Actively participate in and contribute funding and staff resources to the interagency Geospatial One-Stop e-government initiative. (GIO with OEI Program and Regional office. Ongoing)

< Action 5.4.3: Increase participation and coordinate Agency involvement in state and Regional Implementation Team (I-Team) efforts to build the National Spatial Data Infrastructure as appropriate (GIO with OEI, Program and Regional offices. Ongoing)

< Action 5.4.5: Develop an effective approach for funding and leveraging enterprise-wide investments in geospatial data and technologies. (CIO, GIO with the QIC. Summer/Fall 2003)

< Action 5.4.6: Increase the use of Interagency agreements and Memoranda of Understanding (MOUs) to better leverage EPA investments in geospatial activities. (GIO & OEI Staff. Fall/Winter 2003)

NEXT STEPS

Several actions outlined in this Blueprint have already been initiated. Staff and managers across the Agency have gained far more understanding of how EPA uses geospatial data and what the potential for geospatial technologies is in the organization. The GIO position has been advertised and applications received. Discussions about configurations for hardware and data have been initiated and a governance plan has been drafted. Finally, the Agency's Locational Data Policy is being revised as EPA examines the quality of locational information across various programs.

Critical next steps include hiring a GIO and initiating the various actions in this Blueprint. The actions will provide a guide for conducting a return on investment analysis, as well as outlining budget and operating plans. The GIO will provide the leadership necessary to implement the actions in an effective and timely manner. The Blueprint will continue to be used to inform the Enterprise Architecture effort and will assist in ensuring that geospatial activities and needs are recognized as the Architecture is built out. Deploying a geospatial network capable of supporting web-based geoservices will be a key priority on the next FY. As sequencing plans for other information initiatives are developed such as Central Data Exchange, Enterprise Repositories, System of Access, and Exchange Networks, this Blueprint will provide guidance for addressing where and how geospatial efforts support and benefit from those activities.

The governance proposal will be reviewed, discussed Agency-wide, modified as necessary and implemented so that investments and actions carried out meet enterprise needs. Data requirements will be more fully examined as part of the EA efforts implemented by the programs and regions in FYs 2003-2004. Data stewardship responsibilities will be identified as requirements are finalized and priorities for meeting these requirements set through the agreed upon governance structure.

These coordinated efforts will ultimately result in the ability to effectively and efficiently collect, access, interpret, and use geospatial data and technologies to make better environmental decisions. This is the vision of the Geospatial Program.

APPENDICES

Appendix A: Principles for EPA's Geospatial Program

Principles for EPA's Geospatial Program

- Respond to the needs and multiple skill levels of users throughout the Agency and among partner organizations and customers.
- Invest in geospatial technologies and data that directly support EPA business needs giving priority to those that will enhance productivity for the maximum number of stakeholders.
- Foster the cost-effective management of EPA geospatial data and technologies.
- Promote coordination within EPA through adequate stakeholder representation in key decisions related to Agency use of geospatial data and technologies.
- Provide access to the best available data of known origin and quality for environmental decision-making, whether produced by EPA or external partners.
- Rely, as much as possible, on open, market-proven technologies, utilizing cutting- edge and custom-developed tools only where necessary.
- Comply with Federal mandates such as Government Performance Reporting Act, Circular A-16 containing Executive Order 12906 (National Spatial Data Infrastructure), and the Clinger-Cohen Act.
- Facilitate EPA's ability to capture and utilize accurate and documented locational data during transactions such as inspections or state and regulated industry reporting to EPA.
- Encourage and reward innovation in the use of geospatial technologies and data.
- Monitor the performance and benefits derived from EPA's Geospatial Program and manage resources to meet the greatest needs.

Appendix B: Definitions of Commonly Used Geospatial Terms

Aerial Photography: The method of taking photographs from an aerial platform (aircraft). 1) Vertical photography, some times called orthophotography (see entry) is used for photogrammetric mapping and requires a high degree of accuracy. 2) Oblique photography is used for general information, sometimes to verify certain attributes, but does not provide accurate measurements for photogrammetric mapping.

Bandwidth: The term bandwidth in computer networking refers to the data rate supported by a network connection or interface. One most commonly expresses bandwidth in terms of bytes per second (bps). The term comes from the field of electrical engineering, where bandwidth represents the total distance or range between the highest and lowest signals on the communication channel (band).

DBMS: Stands for database management system. A DBMS provides the means to store and manage data.

Distributed, Networked Hardware: Servers and clients distributed throughout an organization and connected via the Internet, Extranet, or Intranet to allow processing on and access to and from multiple platforms.

Enterprise: The enterprise is EPA and its partners in environmental protection. Enterprise activities are those efforts that further the broad needs of EPA and its partners. Geospatial enterprise efforts include the data, services, technology, and expertise that will most effectively meet the most common needs of the most people. An "enterprise approach" is intended to minimize duplication, and foster integration and consistency, while still promoting innovation**.** An enterprise approach for managing geospatial data, technology, and services will not necessarily address every geospatial need within the Agency or between EPA and its partners. Enterprise Architecture is defined by the federal CIO-Council to be a comprehensive series of principles, guidelines, models, diagrams, and standards that:

- depict the existing business, information flows, data, applications, and technology;
- describe the potential impacts of business and technology change drivers on the enterprise;
- recommend a target environment for the enterprise that is aligned with its business and data needs and incorporates overarching processes such as quality and asset management, IT investment, and security management;
- identify a technical reference model (TRM) and standards profile; and
- include a sequencing plan to guide migration from the baseline (current state) to the target architecture.

The Federal Geographic Data Committee ("FGDC"): coordinates the Federal Government's development of the National Spatial Data Infrastructure. FGDC was established by the Office of Management and Budget ("OMB") Circular No. A-16 ("Coordination of Surveying, Mapping, and Related Spatial Data Activities") and chaired by the Secretary of the Department of the Interior ("Secretary") or the Secretary's designee.

Framework Data: Term used by the FGDC in development of the NSDI that describes the data layers most commonly needed and used by most users in the development and use of geographic analyses. These layers often form the base to which other data are attached. The FGDC defined the following seven framework data sets as a means to identify priorities for data collection, but recognizes that many other data sets may be critical for specific agency analyses, including EPA. The agencies primarily responsible for organizing these data on a national basis are noted in parenthesis.

- **Digital orthoimagery** (Department of Interior (DOI) – United States Geological Survey (USGS)):

This data set contains geo-referenced images of the Earth's surface, collected by a sensor. Digital orthoimages have the geometric characteristics of a map and image qualities of a photograph.

- **Cadastral data** (DOI – Bureau of Land Management (BLM)): This dataset describes the geographic extent of past, current, and future right, title, and interest in real property, and the framework to support the description of that geographic extent. The geographic extent includes survey and description frameworks such as the Public Land Survey System, as well as parcel-by-parcel surveys and descriptions.
- **Geodetic control** (Department of Commerce (DOC) – National Geodetic Survey (NGS)): Geodetic control provides a common reference system for establishing coordinates for all geographic data.
- **Elevation** (DOI – USGS and DOC – National Oceanic and Atmospheric Administration (NOAA)): This data contains geo-referenced digital representations of terrestrial surfaces, natural or manmade, which describe vertical position above or below a datum surface.
- **Hydrography** (DOI – USGS): This data theme includes surface water features such as lakes, ponds, streams, rivers, canals, oceans, and coastlines.
- **Transportation** (Department of Transportation (DOT) – Bureau of Transportation Statistics (BTS)): Transportation data are used to model the geographic locations, interconnectedness, and characteristics of the transportation system within the United States. The transportation system includes both physical and non-physical components representing all modes of travel that allow the movement of goods and people between locations.
- **Government units** (DOC – United States Census): These data describe, by a consistent set of rules and semantic definitions, the official boundary of Federal, State, local, and Tribal governments.

Geospatial data: Geospatial data are defined as any data that are referenced to a location on the surface of the earth. This term is often used in place of other terms such as maps, geographic data, or spatial data. It also includes individual point or site specific data that are referenced to a location on the earth and digital aerial imagery of the earth.

Geospatial Data Index (EPA): A system of XML web services providing the user access to metadata records about spatial data (layers) stored in various spatial data servers throughout the EPA. This web site allows internal users to search for, locate and obtain geospatial data, and other related information. The index supports access to and maintenance of FGDC compliant metadata.

Geospatial technologies: Geospatial tools and technologies describe the combination of hardware and software that are commonly used to collect, import, store, manipulate, analyze, and display digital geospatial data. These technologies include geographic information systems (GIS), georeferencing tools (global positioning systems - GPS), remote sensing, and visualization systems.

Geospatial One-Stop: One of 24 OMB electronic-government initiatives that will enhance government efficiency and achieve the vision that government be more citizen-based and results oriented. Geospatial One-Stop will build on investments already made to develop a National Spatial Data Infrastructure (NSDI) and advances in geospatial information technologies to encourage greater collaboration and coordination in their use across all levels of government.

Geoservices: Internet Geoservices are Internet Services that can be requested with a geographic reference or parameter imbedded in the requesting media such as a URL or XML file. The concept here is that an enterprise can share all its our data and applications as long as they are published as Web services. These Internet Geoservices can be used separately or in concert with each other, sometimes referred to as cascading or aggregate services. These include but are not limited to:

- **Geodata services:** Will generate a geospatial data file that can be 'streamed' to an Internet enabled

application. The NWIS access illustrated in WME is an example of a Geodata Service. WME sends a request to the USGS NWIS Web service for an XML file of NWIS data using the coordinates of the 'window' for the request.

- **Georeporting services**: These are typically HTML reports that can be requested with some specified geography in the request string. WME's 'Your Environment' tab is dominated by georeporting services.
- **Geomapping services (Web mapping services)**: Allows the users to print out or view a map of consisting of user selected geospatial data layers. WME is an example of a Geomapping Service.
- **Geographic Interface services**: Will generate a complete interface or a component of an interface to other Internet Geoservices. EnviroMapper is an example of a geographic interface service.
- **Geometadata Service**: - Internet services that provide access and dissemination of metadata for geospatial information. Metadata are a means to determine the content and suitability of data that may be desired to be accessed by GIS users. Geospatial Metadata Services are web services that provide catalogues, search capabilities and links to both the geospatial metadata and data they describe.
- **Geoprocessing/Geoanalysis Service**: Allows the users to put environmental data into a georeferenced format or generate assessments with the geospatial data available. Examples include geocoding,(E.g the user inputs a street address and a - latitude/longitude value is calculated for that address) buffering, and networking/routing.

Geographic Analysis: GIS aids in analyzing geographic data. Geographic analysis uses the geospatial properties of features to look for patterns and trends, and to undertake "what if" scenarios. The most common forms of GIS analyses include Proximity Analysis and Overlay Analysis.

Geographic Information Systems (GIS): Computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data. GIS's are used for solving complex research , planning, and management problems. The major components of a GIS are: a user interface, system /database management capability, database creation/data entry capacity, spatial data manipulation and analysis package, and display generation capacity.

Geospatial Network (EPA): A virtual network consisting of one central node and multiple regional nodes connected via the EPA intranet that will allow the sharing of geospatial data, applications and services throughout the EPA.

Global Positioning System (GPS): A system developed by the U. S. Dept. of Defense that is based on a group of 21 satellites orbiting the earth at very high altitude. GPS receivers are inexpensive and small. GPS is the technology used in vehicle navigation systems.

Imagery: Visible representation of objects and (or) phenomena as sensed or detected by cameras, infrared and multi-spectral scanners, radar, and photometers. Recording may be on photographic emulsion or on magnetic tape for subsequent conversion and display on a cathode ray tube.

Interoperability: The capacity of different systems or components to interact and work together. For instance, two interoperable software systems seamlessly share information and can be "chained" or "connected" to work together as a unified software system.

Land Cover: What can be seen on the landscape - essentially the vegetation and other physical characteristics. Land cover is often mapped using remotely sensed data as cover types can be delineated based on appearance or their spectral reflectance.

Land Use: How land is managed for human purposes. Land use is generally locally regulated in the U.S. based on zoning and other regulations. Land use mapping differs from land cover mapping in that it is not always obvious what the land use is from visual inspection.

Layer: is a subdivision of a CAD or GIS database containing related data. Layers can be visualized as "transparencies" which allow the user to view and analyze information selectively by theme. Some GIS build their databases as a series of layers covering a single area. Layers are fundamental to overlay analysis.

Locationally referenced data: Tags on point or site specific data that are referenced to a coordinate or address on the surface of the earth. (This may also be referred to as **locational data**.)

Map: A representation of a portion of the earth, usually drawn on a flat surface. (From Latin mappa, a napkin, sheet or cloth upon which maps were drawn.)

MRLC: Multi-Resolution Land Characteristics Consortium is an organization formed in 1992 among several federal agencies agreed to acquire satellite-based remotely sensed data for environmental monitoring programs. Original members of the Multi-Resolution Land Characteristics (MRLC) consortium were the U.S. Geological Survey (USGS), Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA) and the U.S. Forest Service (USFS) . Later joining the consortium were the National Atmospheric and Space Administration (NASA) and the Bureau of Land Management (BLM). During the 1990's, the MRLC resulted in several successful mapping programs, including the: (1) Coastal Change Analysis Project administered by NOAA; (2) Gap Analysis Project directed by the USGS Biological Resources Division, and the National Land Cover Data (NLCD) project directed by both the USGS and EPA. The data developed by these projects are available publicly via the Web or by contacting the agencies involved.

National Geospatial Data Clearinghouse: a distributed network of geospatial data producers, managers, and users linked electronically.

National Spatial Data Infrastructure ("NSDI"): The technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data.

N-Tier: An application program is distributed among three or more separate computers in a distributed network. The most common form of n-tier (meaning 'some number of tiers') is the 3-tier application, in which user interface programming is in the user's computer, business logic is in a more centralized computer, and needed data is in a computer that manages a database. N-tier application structure implies the client/server program model. Where there are more than three distribution levels or tiers involved, the additional tiers in the application are usually associated with the business logic tier.)

Open Standards for GIS Software: Common protocols on how GIS information is presented to ensure various systems “talk to each other.”

Overlay Analysis: The integration of different data layers involves a process called overlay. At its simplest, this could be a visual operation. For example, the question: “Does Palmer Colonia lie within a 100 year floodplain?” can be answered by overlaying a flood plain map on a Colonia boundaries map.

Platform: is a another term for computer hardware, including microcomputers, workstations, and mainframe computers. When discussing software, platform independence implies the software can be run

on any computer.

Points: Items such as oil wells, utility poles, etc. Specific objects with exact location noted usually by latitude and longitude.

Polygon: Irregularly shaped area that conforms to the boundaries of some characteristic being mapped (fire protection districts, vegetation type, elevation, etc.)

Precision: The degree of refinement in the performance of an operation, or the degree of perfection in the instruments and methods used when making the measurements. A measure of the uniformity or reproducibility of the result. Precision relates to the quality of the operation by which a result is obtained, and is distinguished from accuracy which relates to the quality of the result.

Proximity Analysis: GIS is often used to answer such questions as

- How many houses lie within 100 m of this water main?
- What is the total number of customers within 10 km of this store?
- What proportion of the citrus crop is within 500 m of the well? To answer such questions, GIS technology uses a process called buffering to determine the proximity relationship between features.

Portal (enterprise): single Internet location through which users can gain access to multiple sources of information and services. A centralized portal offers “one stop shopping”. With respect to geospatial Information is presented in a manner that would be increase the effectiveness of the centralized portal e.g. by tagging all geospatial data to make it readily searchable.)

Remote Sensing: (From the American Society of Photogrammetry and Remote Sensing) “The art, science, and technology of obtaining reliable information about physical objects and the environment, through the process of recording, measuring, and interpreting imagery and digital representations of energy patterns derived from non-contact sensor systems”. Photography is a form of remote sensing. Satellites are a remote sensing platform that collect nearly real-time or periodic imagery for conducting analyses of land cover and land forms based on spectral signatures of various features on the earth.

Thick client: Computer (often desktop) that has full functionality to store and run applications and manipulate data, including input devices (e.g., CD ROM, disk drives), but is connected to a server. Most applications will be run on the computer rather than the server, although data may be accessed from the server.

Thin Client: Low-cost, centrally-managed computer that does not include many applications, data or input devices (e.g., CD-ROM players, diskette drives, and expansion slots). These computers have limited capabilities and will only run essential applications. "Server-based computing" may be used as a synonym for "thin client" because most thin clients today are powered by back-end centralized servers that are capable of serving either “thick” or “thin” clients.

TIGER: Acronym for Topologically Integrated Geographic Encoding and Referencing (Street network files). TIGER data is an automated, single source geographic database of street network files developed for the 1990 census.

Vectors: Lines defined by "x", "y" and "z" coordinate endpoints. Roads, rivers, contour lines, etc. presented as vector lines.

Visualization: For many types of geographic operation the end result is best visualized as a map. Maps efficiently store and communicate geographic information. While cartographers have created maps for millennia, GIS provides new and exciting tools to extend the art and science of cartography.

Web Services: Loosely coupled, reusable software components that semantically encapsulate discrete functionality and are distributed and programmatically accessible over standard Internet protocols. (The Stencil Group (http://www.stencilgroup.com/ideas_scope_200106wsdefined.html#whatare)

XML/GML: XML (Extensible Markup Language) is a flexible way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere. XML, a formal recommendation from the World Wide Web Consortium (W3C), is similar to Hypertext Markup Language (HTML). Both XML and HTML contain markup symbols to describe the contents of a page or file. HTML, however, describes the content of a Web page (mainly text and graphic images) only in terms of how it is to be displayed and how to interact with it. For example, the letter "p" placed within markup tags starts a new paragraph. XML describes the content in terms of what data is being described. For example, the word "phonenum" placed within markup tags could indicate that the data that followed was a phone number. This means that an XML file can be processed purely as data by a program or it can be stored with similar data on another computer or, like an HTML file, it can be displayed. XML is "extensible" because, unlike HTML, the markup symbols are unlimited and self-defining. GML or Geography Markup Language is an XML encodes the geometry and attributes of geographic information for transfer and storage of geographic information.

Appendix C: Proposed EPA Geospatial Data Architecture

As part of both the Geospatial Activities Baseline Assessment and Geospatial Blueprint efforts, initial conversations were held with Regional and Program Office employees about the geospatial data necessary to support their program needs. Additionally, the OEI/Office of Information Collection and Region 3 jointly explored a prototype geospatial data planning process that involved identifying geospatial data needed to support key Region 3 business activities. The information obtained from these efforts served as the basis for developing a preliminary list of the geospatial data sets required to effectively support implementation of business operations Agency-wide. This list will be the starting point for more in-depth conversations with Program and Regional offices to identify the data that will comprise the geospatial component of the Enterprise Repository. These conversations will be held with both the Program and Regional offices as part of the Enterprise Architecture effort currently underway.

These enterprise geospatial data sets will only reside on EPA servers when it is not possible or practical to access the geospatial data from their original sources - the other Federal, state, local geospatial data servers that are part of the National Spatial Data Infrastructure (NSDI). For example, in the long term data and applications users will directly access the USGS master files for National Hydrography Dataset (NHD), National Elevation Dataset (NED), National Land Cover Dataset (NLCD), and the National Watershed Boundary Dataset (NWBD). The government-wide Geospatial One-Stop will support this type of access. EPA geospatial data sets will also be accessible to others within security constraints via Geospatial One-Stop.

The geospatial data sets that are part of the EPA Enterprise Architecture will reside on distributed servers within the National Computer Center (NCC), Regions, and Programs. Regional integrated geospatial data servers, and Program and ORD laboratory integrated geospatial data servers will comprise this repository as a network of data servers. The servers will be organized consistently with data formatted according to FGDC standards. Users of data will be able to access multiple servers transparently and seamlessly (See Figure D-2). All data will be known through the Geospatial Data Index.

Discussions over the next year will determine optimal allocation of data sets based on resources available to support access, resolution, and use of the data, and needs for site specific integration. Geospatial data that are needed by more than one office will have identified “stewards” responsible for ensuing data availability and documented quality. In some cases, data may be duplicated across servers for security reasons. Data for public access will be maintained on separate server. Not all EPA data will be publically accessible. Table C-1 lists the various data sets identified as needed by EPA employees.

Land Use/Land Cover	Hydrography and Water	
National Land Cover Database (NLCD) North American Land Cover (NALC) Omerik level 3 or 4 Ecoregions Bailey Ecoregions	Lakes and Reservoirs Rivers and Streams (National Hydrography Data Set (NHD) Wetlands (National Wetland Inventory) Watersheds (National Watershed Boundary Data Set) Deep aquifer recharge areas (USGS 63 aquifers) Shallow aquifers (depth to water table)	Roads (Interstate, State Highways, Local) Railroad Lines and Yards Navigable Waterways Navigational locks and dams (USCOE Dam Database and river maps) Non Navigational locks and dams (USCOE Dam Database and river maps) Airports/airfields Boat Access Ramps Marinas Oil and gas product pipelines

Table C-1: Initial List of Data Sets Recommended for Inclusion in the Enterprise Geospatial Repository

Hypsography	Population	Geology
National Elevation Dataset (NED) Digital Elevation Models (DEM)	US Census TIGER Files	Bedrock Surficial Geomorphological Features
Species and Critical Habitat Distribution	**Soils**	**Geographic Names**
Multi-jurisdictional Data Set	Soil Survey Geographic Data Base (SSURGO) State Soil Geographic Database (STATSGO) (not as desirable)	Geographic Landmarks Geographic Names Information System (GNIS)
Administrative Boundaries	**Cultural and Historical Features**	**Imagery**
National, Tribal, State, County and Municipal Boundaries Standard Statistical Metropolitan Areas (SMSAs) School, Sewer districts Zip codes Federal Managed Areas (Parks, historic sites, archeological sites) State Managed Areas (Parks, historic sites, archeological sites) Regional Managed Areas (Parks, historic sites, archeological sites) Private managed areas (Parks, historic sites, archeological sites) Special Tribal Areas Unique EPA Boundaries NPL, Superfund, and RCRA Site Boundaries Air Non Attainment Areas Airsheds (by Chemical) Source Water Protection Boundaries, Wellhead Protection Areas Risk Management Plan Boundaries, Facility Response Plans State Water Quality Standards and Designated Uses TMDLs, Designated Use Segments and 303d Planning Areas	Landmarks and Monuments Government Buildings (including Post Offices) Churches Fish Hatcheries Business Locations (Dunn & Bradstreet) Recreational Areas Land Ownership Cemeteries Golf Courses Landfills Military Bases Septic Systems Weather Stations	Landsat TM imagery used to develop the National Land Cover Data Set Aerial Photographs Digital Orthophoto Quarter Quads (DOQQ) Scanned Topographic Maps All high resolution imagery procured by the Agency

Initial Agency discussions have outlined specific responsibilities for ensuring the reliability of and access to needed geospatial data within EPA. Table C-2 makes the distinction between small scale (e.g., equal to or smaller than 1:100 K scale) national data and regional or site specific data which exist at larger scales and are often not complete for the nation. Georeferenced and Programmatic data represent EPA specific data. Data stewards are individuals who will report on the availability of data to the GDI, as well as tend to the quality of the data.

Table C-2: Proposed Data Responsibilities

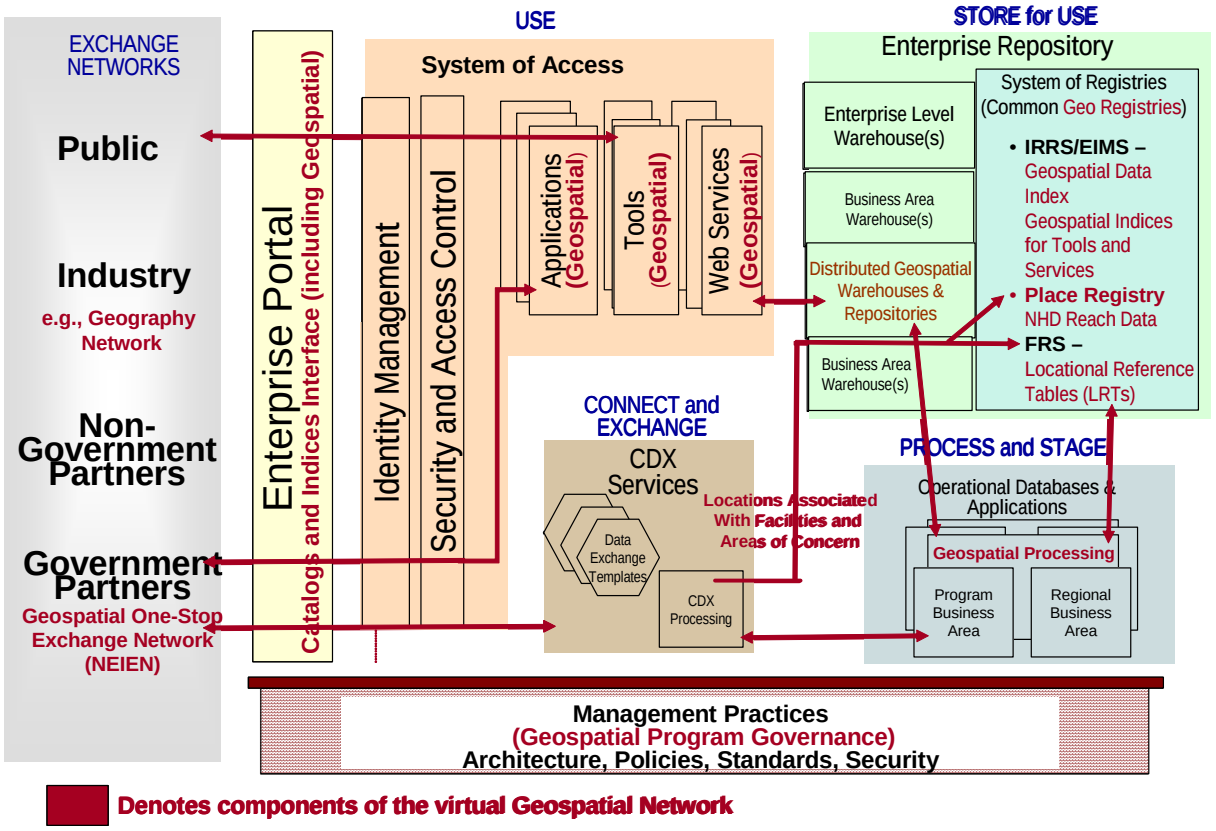
EPA GEOSPATIAL BLUEPRINT			
Type of Data	**National Data (1:100K scale and smaller)**	**Regional & Site Specific Data (larger than 1:100K scale)**	**Georeferenced Programmatic and Financial Data**
Resolution	Primarily +/- 100K and smaller	Primarily accuracy greater than +/- 40' (e.g., 1:24K scale and larger)	Based on EPA locational accuracy policy, goals and projected standards
Resides	National Geo Data Server (may be replicated at regional server level) or other Federal Agencies	Regional Geo Data Servers or State Agencies	Program Data Servers (Enterprise Repositories)
Stewarded By	OEI or Designated Program Office	Designated Regional or Programmatic Geospatial Data Stewards	Designated Program Steward
Primarily Collected By	Federal Agency Partners and/or Federal Agency Partners with State partners	State/Local Partners or Contractors	State Partners or Agency Program Offices
Security	Access may be restricted for licensed data sets; otherwise the public may view data through viewers (e.g., EnviroMapper; Windows-To-My-Environment)	States may negotiate access depending on sensitivity and licensing restrictions	Negotiated access to Partners, Contractors. Public access through viewers (e.g., Window-To -My environment)
Supported By	OEI or Designated Program Office	Designated Regional or Programmatic Geospatial Data Stewards	Designated Program Steward
Metadata By	Original data providers/ OEI and Program Data Stewards.	Original data providers/ Regional Geo Office on repackaged data	States & other data originators
Data Examples	Census, Topography/ DEMs, NHD - Hydrography (OW) Low resolution Satellite Imagery - (MRLC) Transportation (Geocoded Street Files, rail & sea, etc.)	Detailed Hydrography or Transportation Land Use High Resolution Imagery/Orthophotos	Programmatic Spatial (303d Sites, Permitted Facilities, TRI, etc.)

Appendix D: Proposed Technology Architecture to Support Geospatial Applications and Data Access

As previously discussed, geospatial data and technologies are recognized as key components of the overall EPA Enterprise Architecture. No place is this more prevalent than in the technology component. The same hardware will support geospatial functionality, word processing, database management, and so forth. The primary technology challenge in the use of geospatial data tends to be network capacity. Over the last year members of the OEI Geospatial Team and Geospatial Blueprint Team have been working closely with the Enterprise Architecture team to ensure coordination in goals and objectives, and recognition of unique geospatial processing requirements.

Figure D-1 schematically depicts the geospatial components of the Enterprise Architecture at EPA. The drawing illustrates how the geospatial elements fit into the other key enterprise components under development. This drawing highlights the geospatial pieces and provides considerably less detail on the other components. The diagram will be used as a starting point in discussions with EPA staff designing other enterprise components and in developing the integrated project and sequencing plans for the OEI components of the Environmental and Public Heath Protection Architecture (to be initiated in the spring of 2003).

Figure D-1: **Geospatial Components** in the Target Enterprise Architecture

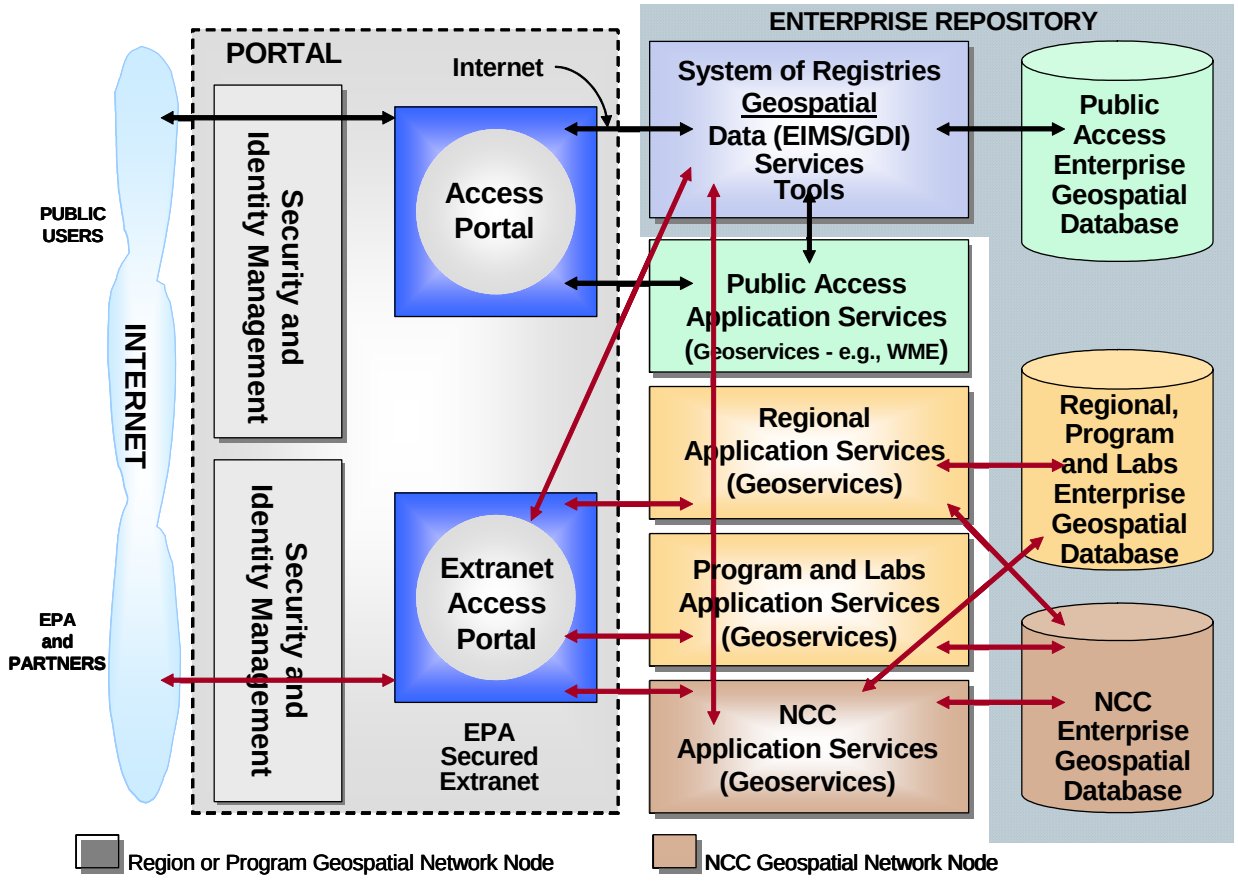


As part of the Geospatial Blueprint planning effort, members of the OEI Geospatial Team and National GIS Workgroup have jointly defined and proposed a preliminary design for the Geospatial Technical Architecture. The EPA Geospatial Network (See Figure D-2), comprised of geospatial data, applications, and technologies, is designed to be integrated within the Enterprise Architecture through the System of

Access, CDX, System of Registries, and Enterprise Repository. The Geospatial Network will significantly improve and simplify the exchange and sharing of GIS databases and applications among Regional and Program Offices, Research Laboratories, and the NCC. It will utilize Web Services and new technologies to improve efficiency, minimize duplication; and save costs.

The Network, which is comprised of a series of NCC, Program, laboratory, and Regional Nodes consists of linked data and application servers. This configuration will enable each node to provide geospatial data, metadata, analytical and/or application Web Services. Each node will have a standard minimum level of functionality/performance which will include requirements for comprehensive, current, metadata

Figure D-2: EPA Internal Geospatial Architecture



for all datasets. These nodes will represent components of the overall Agency Enterprise Architecture and will support metadata that may be stored locally or within EIMS, but in both cases accessible through a Geospatial Data Index as part of the Enterprise Architecture and the Geospatial Network. XML/GML and SVG open standards will be the basis for transporting data. FGDC and Agency standards will be required, and national and international standards will tie the Geospatial Registries within the System of Access to facilitate discovery and access to the data. Figure D-2 provides additional details on the components and flows relative to geospatial data and highlights the different infrastructures needed to respond to different users and levels of security. The dark blue arrows represent the general public, with access to some, but not all EPA data. The dark red lines show EPA users and/or their partners who have established Trading Partner Agreements or Memoranda of Understanding to ensure the security of EPA data. The orange boxes are indicative of what will comprise the Regional or Program office component/node of the EPA geospatial network and the pink boxes are the National Computer Center component/node of the EPA geospatial network.

Utilizing existing and proposed communications hardware (routers, T1 and T2 lines, switches, WAN and LAN), the Geospatial Network will be physically integrated with the rest of the Agency telecommunications infrastructure, but will provide a virtual geospatial network. The virtual network will allow Regional, Program, and Research Laboratories to host the geospatial data related to their local environmental protection activities. This provides these offices the means to manage the data they need most. The local hosting will allow Regional, Program and Research Labs to efficiently conduct geospatial analysis, create maps, update databases, and create new data and application performance. Minimizing the separation for the local/specialized data used primarily by these offices maximizes the resources at the local site and reduces the bandwidth load over the network for the entire Agency. National data sets will be hosted on the NCC node; however, over time base coverages (such as NED, NALC, MLRC) will be retrieved from the host agency via established connections such the Geospatial One-Stop Portal. Data replication requirements will need to be established as they pertain to security and disaster recovery. Data utilization (who, what, when, how often) will be a determining factor for where data are hosted.

Web services will be developed and deployed across the Geospatial Network. These Web services will provide the various levels of data access required by the users. Web services will provide users with tools and applications to assist in metadata creation, cataloging, querying, and analysis.

In early November 2002 a survey was sent to EPA Programs and Regions to help determine the architectural requirements and resource needs for the nodes on the Geospatial Network. Issues that were raised included:

- Level of service required of each node on the network
- Capacity to participate
- Architectural options and tradeoffs for deployment (e.g., distributed, centralized, mixed)
- Requirements to support distribution
- Long term support needs
- Keeping pace as technology changes
- Organizational issues

The results of this survey have been posted to the National GIS Workgroup web site for use in developing node requirements and as input to the overall EPA Enterprise Architecture effort. Based on these results the NCC staff developed a list of proposed hardware and software components for each node on the EPA Geospatial Network (Table D-1) The Geospatial Network is currently being built with available equipment (hardware/software) at both the NCC and the Regional Sites. This ad hoc construction will not guarantee the level of performance and capacity necessary to sustain EPA geospatial needs, but will provide the initial proof of concept and a test platform for further functionality and utility. For more information on how and why the Geospatial Network will utilize a Regional node configuration, please refer to document “Recommendation on Building a Geospatial Node in EPA Regional Offices” (April 2003) posted on the National GIS Workgroup web page.

The Regional Node Survey provided the base information about the current physical makeup and available resources that could be utilized to construct each Regional node. The results of the survey showed that most Regions have the required software licenses to support an initial rollout of the Geospatial Network. The largest shortfall is believed to be on the hardware side. Further investigation is needed to catalog the system specifications of the available equipment and run a comparison against the recommended standard configuration specifications. The second shortfall is in trained personnel to support a distributed database that will be accessible across the network. This represents a training need for Regional, Program and Research Laboratory personnel in database management skills and tools. Most of these individuals have general GIS knowledge and skills and have access to other personnel with database management skills, but they lack the overall data hosting and spatial database skills.

The next steps for training GIS personnel in the Regions will consist of the following:

1. GIS personnel will attend general vendor-offered GIS training courses relating to Oracle Spatial Database administration, ArcSDE, ArcIMS and Windows2000 administration.
2. OEI Geospatial Program Support will create and conduct a basic geospatial node development and administration course (specific to EPA environment).
3. OEI Geospatial Program Support will conduct on-site support and hands-on training visits to each region developing a node.

The vendor-offered training will provide base knowledge and skills. The training provided by the OEI Geospatial Program support will provide knowledge on applying vendor software within the unique EPA geospatial environment. The on-site visits will provide tailor-made solutions and training required by each site. Additional information on this approach can be obtained from the document "Recommendation for Building a Geospatial System for EPA Regional Offices" (April 2003) which is posted on the National GIS Workgroup Website.

The NCC node will need considerable upgrading to enable hosting large national datasets, applications, tools and connection services. Presently, there is no hardware available to begin construction. The UNIX server is the largest and most crucial piece of hardware required by the NCC node. The central node will be responsible for hosting a large quantity of data for the agency, acting as temporary (possibly permanent) host for Regional data until Regional nodes can be built, hosting national Web services and tools, and facilitating connections between all geospatial nodes. Without a strong central node, performance and communication will be severely affected. The Geographic Data Index (GDI), Environmental Information Management System (EIMS) and the Integrated Geospatial Database (IGD) will be integrated and/or linked into the NCC central node once the hardware is in place. The linking of these systems into the NCC node will provide all users a permanent and continuous connection to GDI, EIMS, and IGD. The linking will also allow developers to create applications that access these systems directly. The OEI Geospatial Team will continue to solicit cooperation from other geospatial data owners for inclusion in the network.

Trusted partners will be able to access EPA data via the Geospatial Network. Controls will be in place that will allow access to approved data sets. Controls can also be set up to allow only a certain type of access (view, download, read/write, etc.).

Table D-1: Node Requirements for the Geospatial Network

	Region or Program Node	NCC Node
Hardware for Database	• Quad Processor Intel Xeon 2.0 GHz/2MB Cache • 4 GB DDR SDRAM (4x1GB) • 326 GB 15K RPM Ultra3 SCSI Hot Plug Hard Drive • Two integrated 10/100/1000 ethernet adapters • Redundant power supplies • 15 E551 Monitor • Window 2000 Server operation system • 24 X IDE Internal CD-RW/DVD ROM Drive (Estimated Cost $27K)	2-3-Unix Servers (Specifications for the UNIX servers is under development) (Estimated Cost-$300-450K)
Hardware for Applications	• Dual Processor Intel Xeon 2.8 GHz/512K Cache • 4 GB DDR SDRAM (8x512MB) • 150 GB 15K RPM Ultra3 SCSI Hot Plug Hard Drive • Two integrated 10/100/1000 ethernet adapters • Redundant power supplies • 15 E551 Monitor • Window 2000 Server operation system • 24 X IDE Internal CD-RW/DVD ROM Drive (Estimated cost $9K)	(2) Windows 2000 Servers (development of specifications for the Windows 2000 servers is in work) (Estimated cost $24-36K)
Software	Spatial Data Management Software (Estimated Cost $25-30K)	Spatial Data Management Software (Estimated Cost $60-85K)

(NOTE: Node Requirements for the Geospatial Network were referenced from the document "Recommendation on Building the EPA Geospatial Network" (April 2003??)

Table D-2: Proposed Skill Mix for Maintaining and Operating a Node on the Geospatial Network

Oracle Data Base Administrator	Web Services Developers
Spatial Data Engine (SDE) Administrator	Spatial Data Management and Documentation
Web Server Administrator	Internal Consultants/Application Requirements
ArcIMS Administrator	

(NOTE: Node Requirements for the Geospatial Network were referenced from the document "Recommendation on Building the EPA Geospatial Network" (April 2003)

Next Steps

The dialogs on the geospatial technoloy architecture/Geospatial Network and the resulting proposals are considered a tool to work with those responsible for designing and implementing the broader EPA Enterprise Architecture. The proposed Geospatial Network will work within the Enterprise Architecture in concert with the System of Access, the Enterprise Repository, and the System of Registries, and CDX. The proposed diagrams and specifications will be used as a starting point for working with others who are currently developing overall project plans and sequencing plans for the Environmental and Health Protection architectures. Over the next 3-6 months the following activities will be undertaken to complete the design and cost assessment for the proposed geospatial network to prepare for these dialogues.

- Work closely with the EPA's wiring upgrade effort to ensure that the telecommunications network will provide adequate bandwidth for the Geospatial Network.
- Catalog existing Regional and Program geospatial equipment and compare against the recommended standard configuration specifications to determine investments needs.
- Finalize skill mix necessary to maintain and operate a node on the Geospatial Network
- Investigate the FTE requirements of all locations supporting the Geospatial Network and provide possible solutions and/or options to meet these requirements.
- Revisit the training requirements issue to ensure that GIS personnel have the necessary skills.
- Generate the finalized costs and incremental funding necessary to fully implement the proposed Geospatial Network.
- Examine issues associated with external access to the EPA Geospatial Network and propose approaches for secure access.
- Develop a cost-benefit analysis document for this proposal in coordination with enterprise architecture efforts.

Appendix E: Proposed EPA Governance Architecture

Participants in the Geospatial Blueprint effort placed a high priority on establishing a strong focal point for coordinating geospatial efforts Agency-wide and clarifying the roles and responsibilities of OEI, Programs, and Regions. Numerous discussions on roles and responsibilities were held with members of the Geospatial Blueprint Team, the National GIS Workgroup, and the OEI Geospatial Team between November 2001 and March 2002. The recommendations from these discussions are summarized in Tables E1-E3 of this Appendix.

The Assistant Administrator for Environmental Information charged several EPA staff from OEI, the Programs, and Regions to propose a governance structure for EPA geospatial activities at the end of 2002. The information contained in this Appendix was used as a starting point to develop a proposal on the scope and functions of a Geospatial Governance Group. The draft Geospatial Governance Group proposal was submitted to OEI senior management for review in March 2003.

Table E-1: OEI Responsibilities

Geospatial Information Officer (GIO)	OEI Geospatial Team	OEI Geo Staff
Managed or Directed by:		
Assistant Administrator for Environmental Information/Chief Information Officer	Office of Information Collection	OEI Office Directors
Includes:		
Senior person on the staff of the Assistant Administrator for Environmental Information/Chief Information Officer	Chair by OIC Senior Staff from OIC, OIAA, OTOP, QS, and OPRO Ad hoc members from Enterprise Architecture and other efforts as needed	Existing OEI geo-related staff in OIC, OIAA, OTOP, QS and OPRO.
Responsibilities:		
- Provides overall coordination and support for OEI-wide and Agency geospatial activities. - Works with CIO/GIO from other organizations to establish co-ops and agreements for data, services, projects, etc. - Promotes Strategic thinking in the geospatial arena and ensures full integrated into the Enterprise Architecture and Information Integration work - Chairs the Geospatial Subcommittee of the QIC - Lobbies for Financial Support for enterprise geospatial activities in QIC - Seeks advice from the OEI Geospatial Team on program and resource needs, discusses progress on OEI-wide coordination issues, and progresses on establishing developing an enterprise-wide geospatial environment - Represents the Agency in external coordination activities regarding geospatial data, standards etc.	- Serves as a permanent coordination and consensus building body on Geospatial issues and efforts across OEI - Ensures that the OEI's resources for and investments in the Agency Geospatial Program are managed efficiently and effectively - Shares information among all parts of OEI involved in geospatial activities - Ensures that work of all OEI geospatial staff is coordinated and brings geospatial staff into meetings as necessary to ensure this coordination. - Identities Agency-wide Geospatial Program needs	- Conduct national geo needs assessments - Identify Agency expenditures and returns on geospatial investments - Provide Agency-wide training for geospatial tools and data management - Coordinate development of geo applications to meet common user needs - Coordinate hardware and software acquisition (blanket purchase orders) - Coordinate access to national geospatial data sets - Provide guidance on implementation of the EPA Quality System - Enable means to maintain live data and application inventories - Coordinate the provision of special services (e.g., visualization needs, image processing) - these may be provided through the private sector - Negotiate data sharing agreements with other federal agencies and the private sector - Provide background research and recommendations to the Environmental Data Standards Council on needed geospatial standards - Implement standards adopted by the Environmental Data Standards Council.

Table E-1: OEI Responsibilities		
		- Lead interagency coordination and planning efforts

Table E-2: Proposed Responsibilities of Agency-wide Governance Entities	
Geospatial Subcommittee of the QIC	**National Geospatial Workgroup**
Managed or Directed by:	
GIO	Geospatial Subcommittee of the QIC
Includes:	
Division and/or Branch Chiefs managing programs using or having direct responsibility for implementing geospatial data, tools or technology	AA/RA designates one voting member All interested staff invited to participate.
Responsibilities:	
- Provide advice, guidance and recommendations to the CIO/GIO, OEI line management, QIC, and the EPA/State Environmental Data Standards Council on achieving the corporate vision for an enterprise-wide geospatial environment. Areas covered include: A Geospatial program strategic direction, priorities, and investments A Geospatial data development, management and dissemination A Geospatial standards development, adoption, and administration A Geospatial applications development and implementation A Evaluation and acquisition of geospatial technologies A Geospatial technical support services A Geospatial training and technology transfer - Ensures the integrated development and management of geospatial data and technology at all levels of the EPA by: - Defining priorities for enterprise geospatial data and technology investments - Working with the CIO/GIO to develop annual budget requests for geospatial data and technologies - Chartering and overseeing permanent working groups or ad hoc task teams as needed to undertake specific assignments and/or projects based on recommendations of the OEI Geospatial Team and/or the National GIS Workgroup (e.g.,National GIS WorkGroup LDIS, Geospatial Data Quality Standards Team)	- Is accountable to the Geospatial Subcommittee of the QIC and the CIO - Advises and makes recommendations to the Geospatial Subcommittee of the QIC on priorities for applications. development and related data and technology needs related to these applications. - Serves as the Agency forum for discussing geospatial technical issues and related policy issues - Serves as the focal point for coordinating needs assessments and application development for specific business areas (e.g., EJ, TMDLs, NEPA, emergency response) and ensuring that they are developed in a manner conducive to an enterprise Geospatial environment. - Works in partnership with the OEI Geospatial Team on Agency-wide strategic and budget planning efforts.

Table E-3: Geospatial Responsibilities By Enterprise Architecture Component Across EPA

OEI	Program Offices	Regions
Business Process • Ensure that geospatial issues are addressed as part of the overall Enterprise Architecture effort and that geospatial elements are integrated into each EA component. • Co-lead Enterprise Business Workgroups (e.g., WME) with Agency Programs Data • Identify and make available enterprise geospatial and imagery data • Host enterprise geospatial data sets at NCC and make available via a variety of mechanisms including the Integrated Geospatial Data Base, FTP sites etc. • Develop and/or adopt national/international geospatial content, metadata, quality, and transfer standards • Manage Agency-wide metadata system • Provide guidance on implementation of the EPA Quality System Technology • Provide technical advice to Program and Regional offices on geospatial technologies • Perform technical support and service functions for Program Offices • Manage Agency-wide geospatial Infrastructure and services via the Working Capital Fund mechanism • Provide support services through the Working Capital Fund for the development, testing and production (hosting) activities • Partner with appropriate components of OEI to ensure that the Agency telecommunication network can support Agency geospatial needs Applications • Develop Agency-wide enterprise applications/ tools e.g. WME. EnviroMapper in cooperation with Agency stakeholders • Test innovative applications for use in Agency business • Work with Program Offices and Regions to develop analytical procedures that have agency-wide applicability (e.g. Wetland Change detection, urban sprawl tools etc.) • Partner with ORD to bring geospatial tools developed for research purposes into the EPA mainstream Governance • Perform GIO functions for the Agency • Lead strategic planning efforts related to geospatial program direction • Support QIC subcommittees with geospatial responsibilities • Participate in National GIS workgroup • Coordinate Agency-wide participation in and communication about interagency activities	Business Process • Identify and document business processes that use or could use geospatial data and technologies Data • Conduct Program needs assessments and provide feedback to OEI re enterprise needs • Be stewards/managers for specified enterprise data sets. • Collect geospatial data for specific projects and programs Technology • Maintain servers to support access to National Data Systems (e.g., PCS, AIRS, STORET) as necessary Applications • Coordinate needs and application development for specific business areas (e.g., EJ, TMDL's, NEPA, emergency response) • Act as enterprise stewards for specified applications Governance • Provide representatives for geospatial coordination • Provide at least one representative to participate on the National GIS Workgroup • Convene Program specific geospatial working groups to identify needs and coordinate within the Program	Business Process • Work with Program Offices to identify and document those business processes that use or could use geospatial data and technologies • Identify Region-specific needs Data • Conduct regional needs assessments and provide feedback to OEI re enterprise needs • Participate in state and regional geo coordination groups • Negotiate state geodata interactions • Maintain the regional component of the national geospatial data repository Technology • Establish, maintain, and upgrade the regional geospatial infrastructure (node) Applications • Develop small scale applications that incorporate new approaches and new business ideas to support local needs. • Conduct prototypes and proof of concepts, share with EPA GIS counterparts and scale up to enterprise solutions as appropriate. • Act as enterprise stewards for specified applications Governance • Provide representatives for geospatial coordination • Provide at least one representative to participate on the National GIS Workgroup • Identify regional lead to oversee and coordinate regional geospatial activities